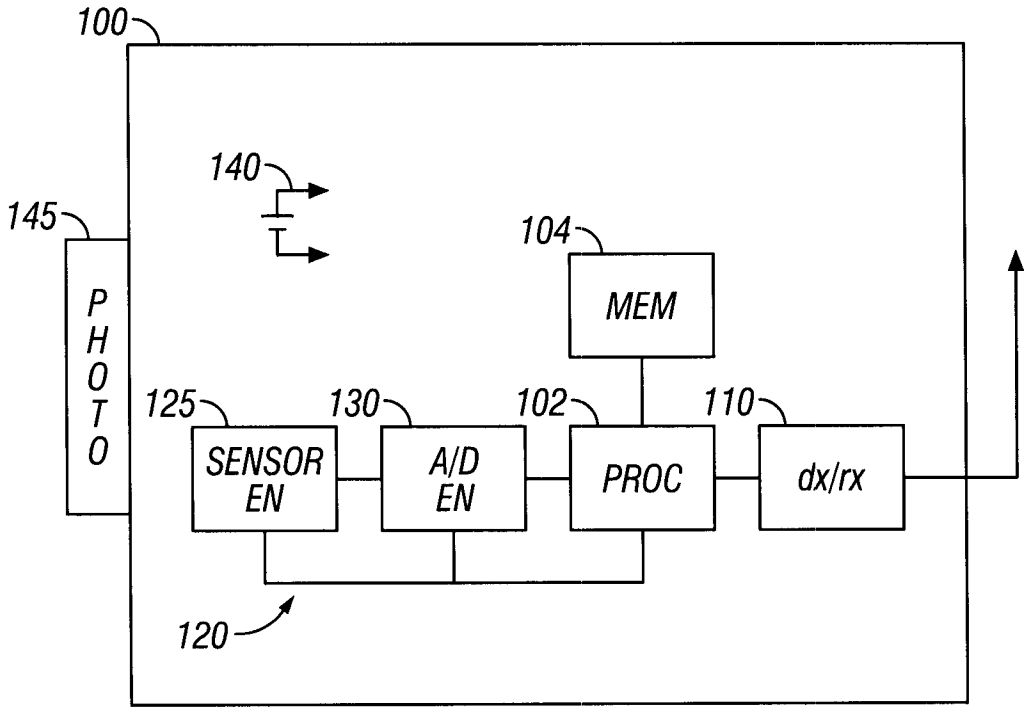
100
140
145
104
MEM
PHOTO
125
130
102
110
SENSOR EN
A/D EN
PROC
dx/rx
120

FIG. 1

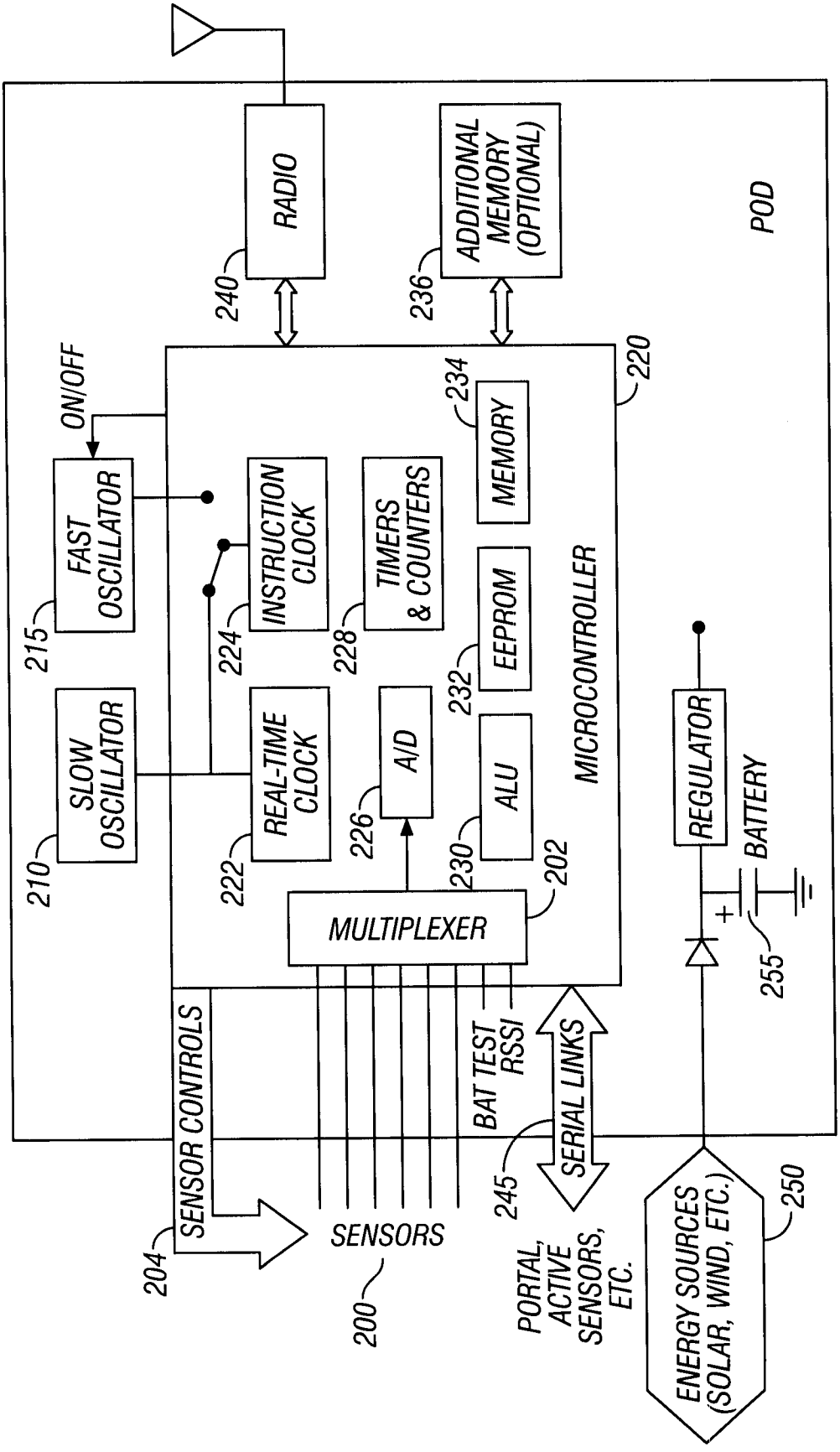
RADIO
240
ADDITIONAL MEMORY (OPTIONAL)
236
POD
ON/OFF
FAST OSCILLATOR
215
INSTRUCTION CLOCK
224
TIMERS & COUNTERS
228
MEMORY
234
220
EEPROM
232
MICROCONTROLLER
SLOW OSCILLATOR
210
REAL-TIME CLOCK
222
A/D
226
ALU
230
202
REGULATOR
BATTERY
255
MULTIPLEXER
SENSOR CONTROLS
204
SENSORS
200
BAT TEST
RSSI
245
SERIAL LINKS
PORTAL, ACTIVE SENSORS, ETC.
ENERGY SOURCES (SOLAR, WIND, ETC.)
250

FIG. 2

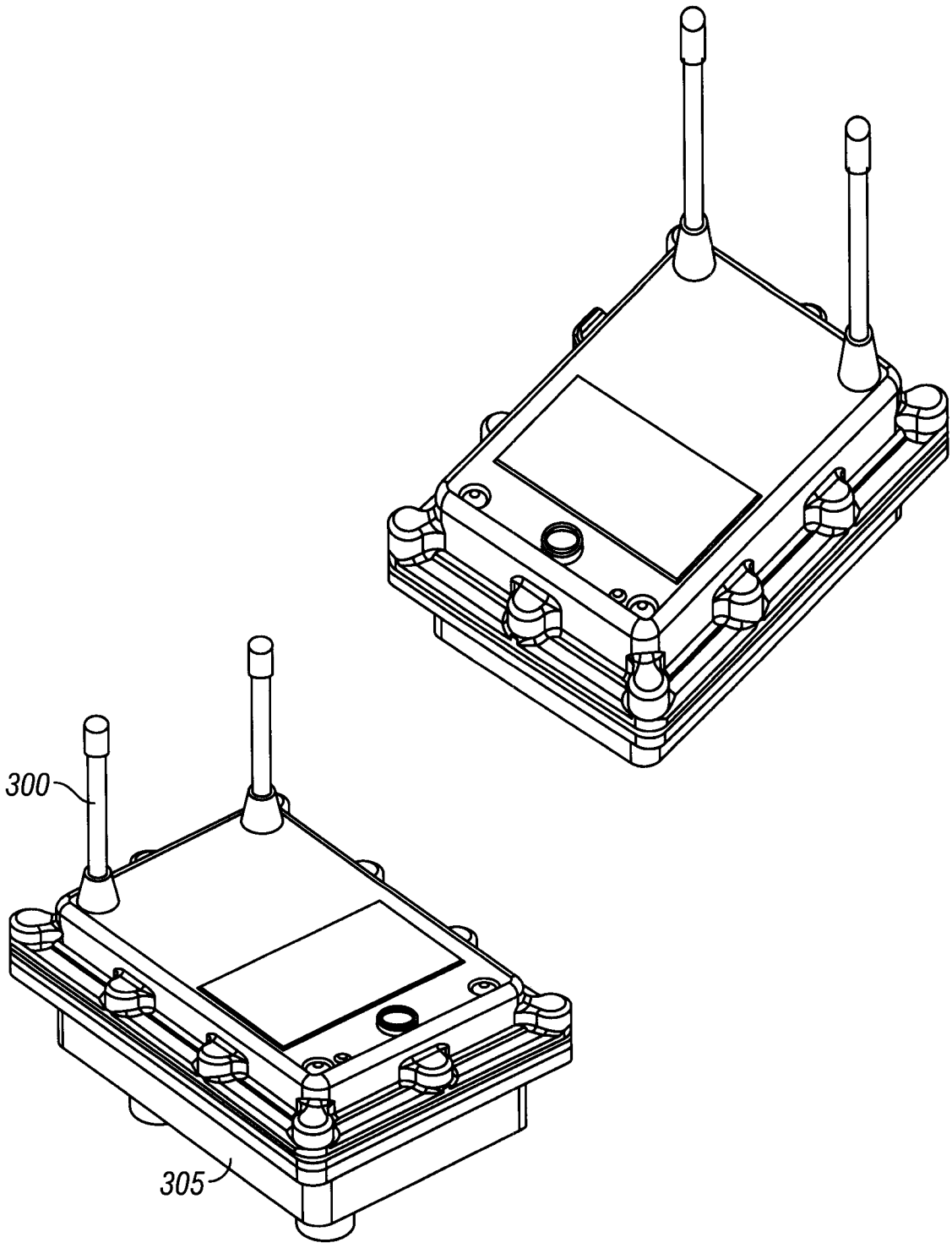

FIG. 3

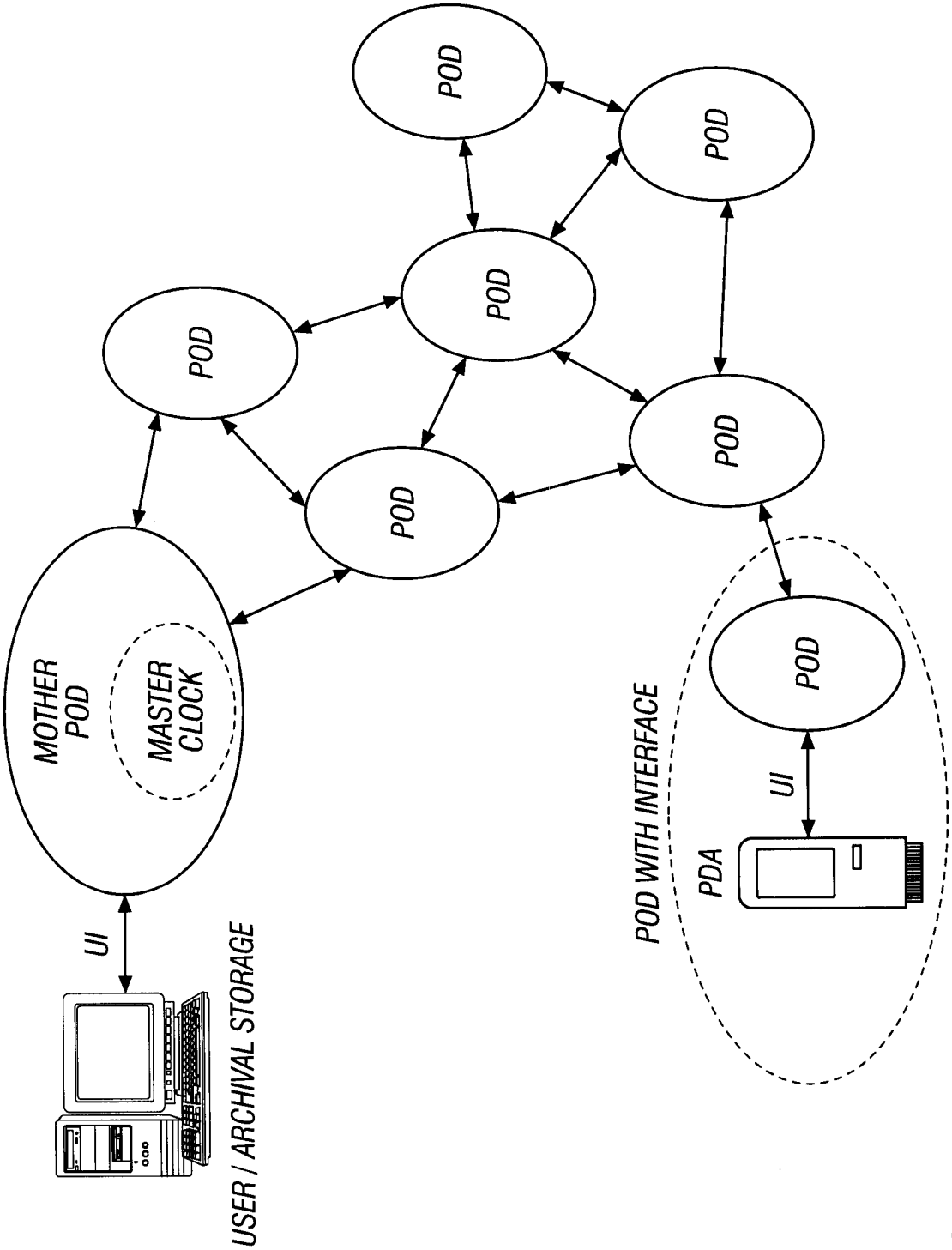
POD
POD
POD
POD
POD
POD
MOTHER POD
MASTER CLOCK
UI
USER / ARCHIVAL STORAGE
POD WITH INTERFACE
POD
UI
PDA

FIG. 4

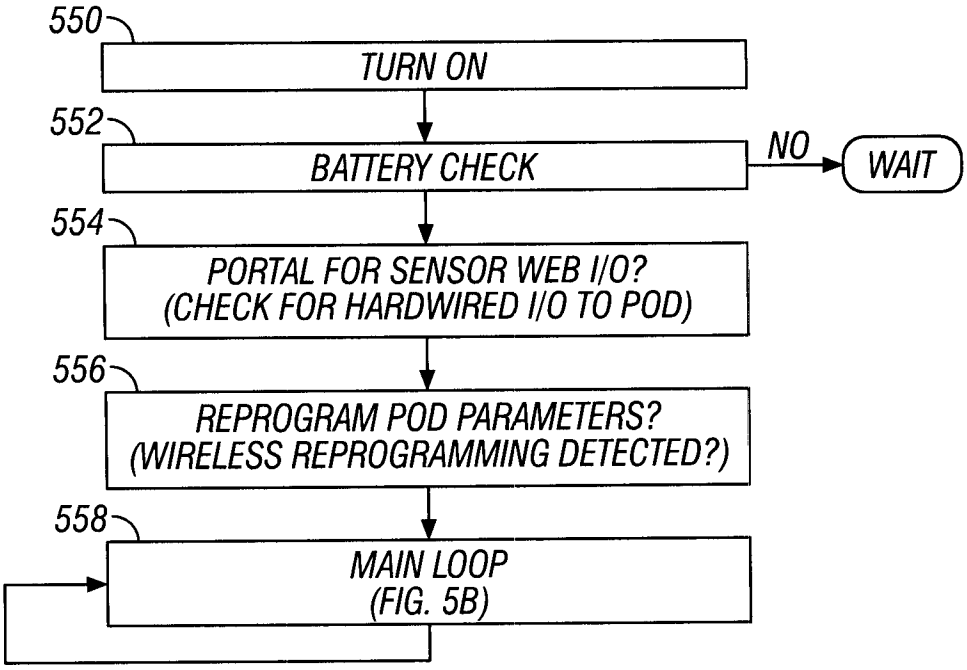
550
TURN ON
552
BATTERY CHECK
NO
WAIT
554
PORTAL FOR SENSOR WEB I/O?
(CHECK FOR HARDWIRED I/O TO POD)
556
REPROGRAM POD PARAMETERS?
(WIRELESS REPROGRAMMING DETECTED?)
558
MAIN LOOP
(FIG. 5B)

FIG. 5A

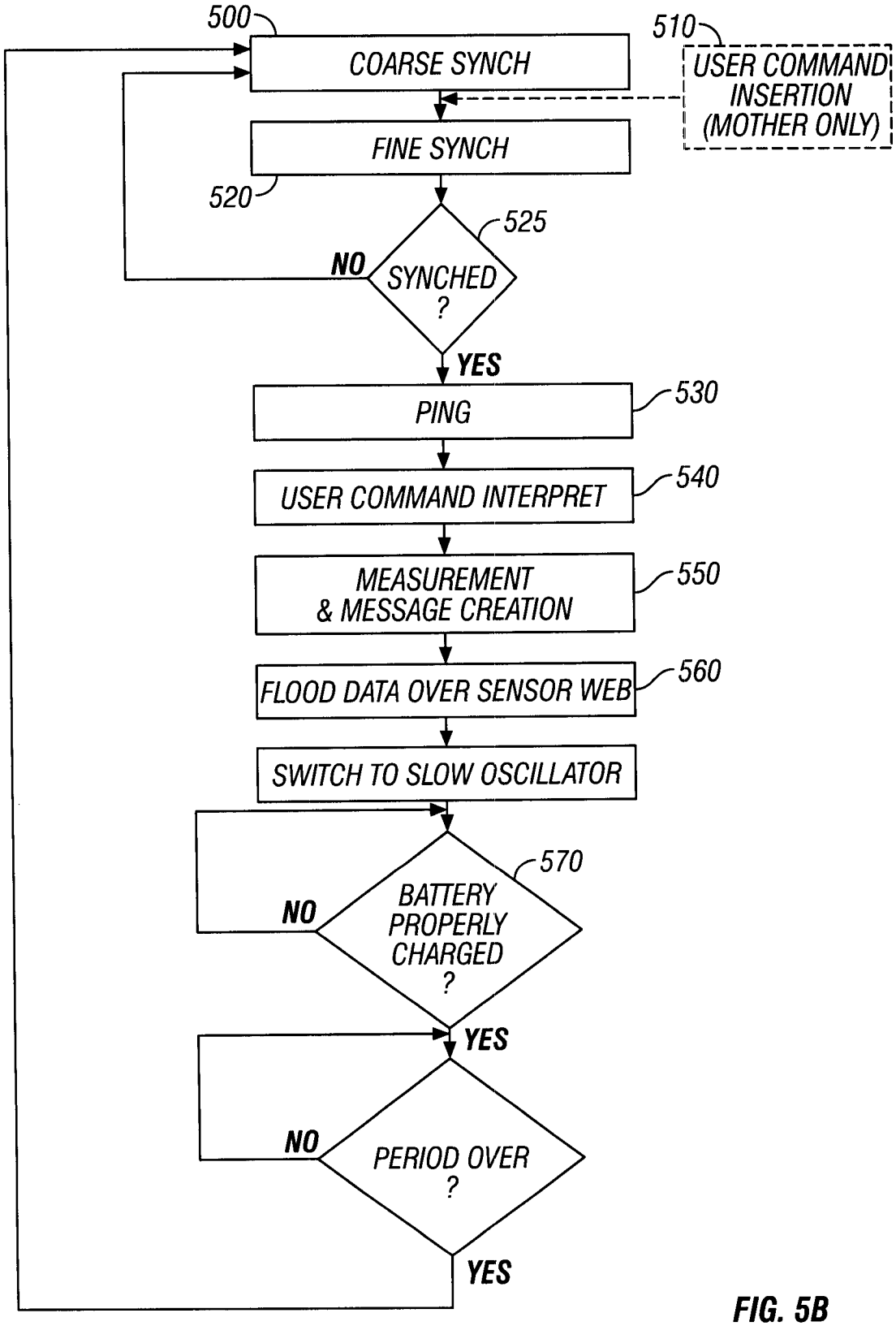
500
COARSE SYNCH
510
USER COMMAND INSERTION (MOTHER ONLY)
FINE SYNCH
520
525
NO
SYNCHED ?
YES
PING
530
USER COMMAND INTERPRET
540
MEASUREMENT & MESSAGE CREATION
550
FLOOD DATA OVER SENSOR WEB
560
SWITCH TO SLOW OSCILLATOR
570
NO
BATTERY PROPERLY CHARGED ?
YES
NO
PERIOD OVER ?
YES

FIG. 5B

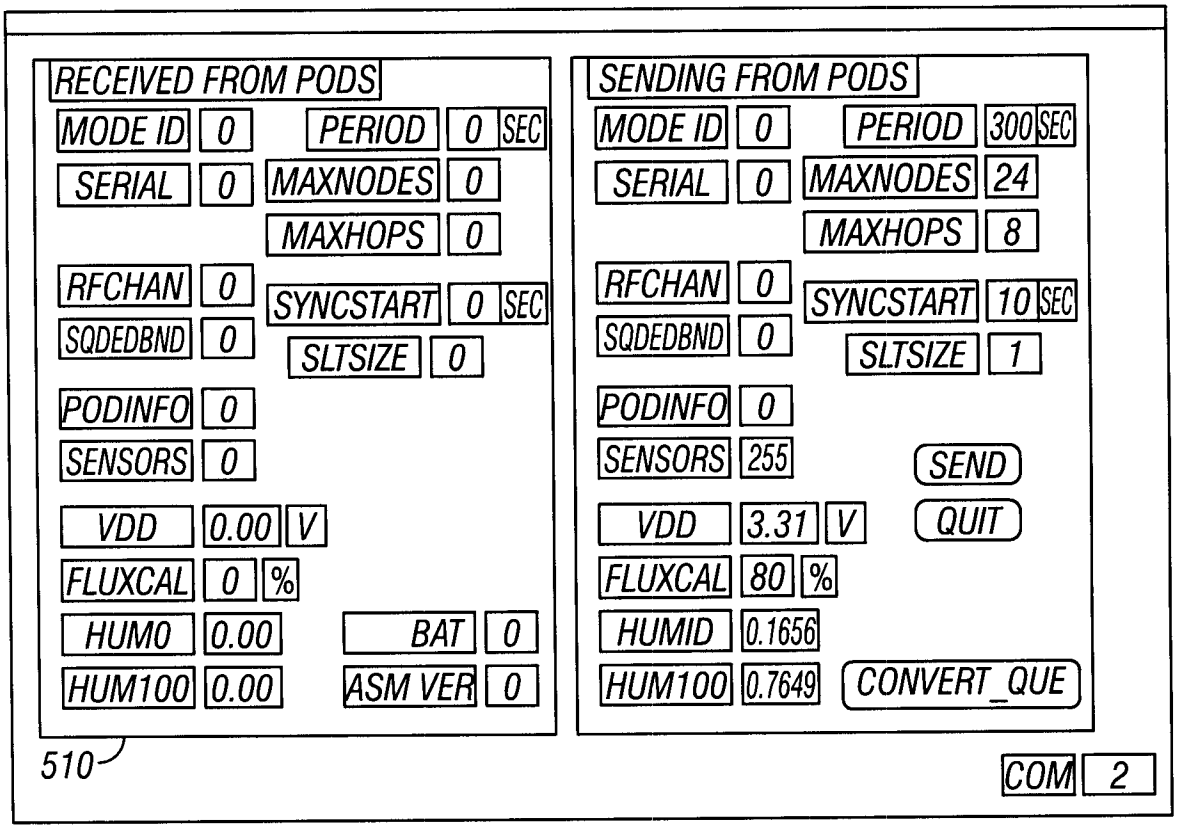
RECEIVED FROM PODS
MODE ID 0
PERIOD 0 SEC
SERIAL 0
MAXNODES 0
MAXHOPS 0
RFCHAN 0
SYNCSTART 0 SEC
SQDEDBND 0
SLTSIZE 0
PODINFO 0
SENSORS 0
VDD 0.00 V
FLUXCAL 0 %
HUM0 0.00
BAT 0
HUM100 0.00
ASM VER 0
510
SENDING FROM PODS
MODE ID 0
PERIOD 300 SEC
SERIAL 0
MAXNODES 24
MAXHOPS 8
RFCHAN 0
SYNCSTART 10 SEC
SQDEDBND 0
SLTSIZE 1
PODINFO 0
SENSORS 255
SEND
VDD 3.31 V
QUIT
FLUXCAL 80 %
HUMID 0.1656
HUM100 0.7649
CONVERT_QUE
COM 2

FIG. 5C

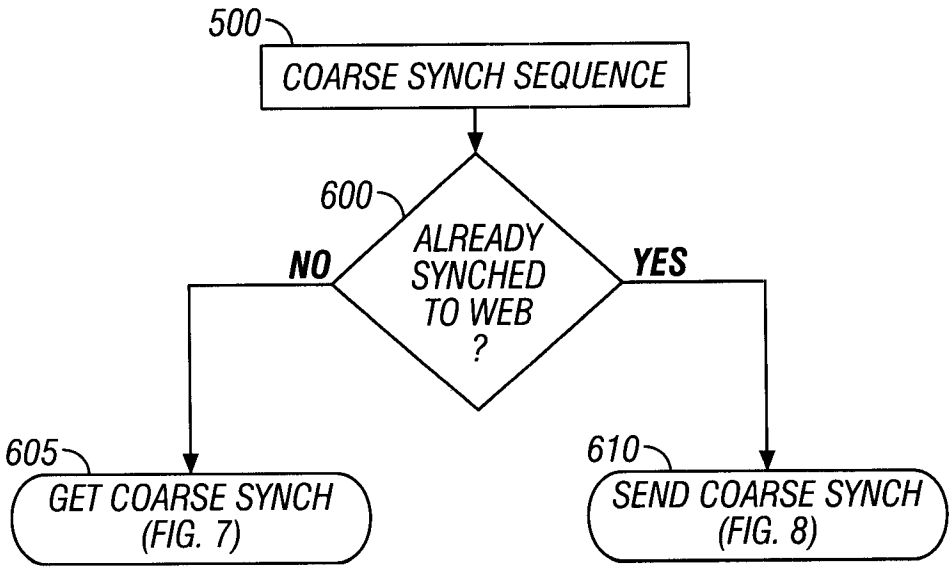
500
COARSE SYNCH SEQUENCE
600
ALREADY SYNCHED TO WEB ?
NO
YES
605
GET COARSE SYNCH (FIG. 7)
610
SEND COARSE SYNCH (FIG. 8)

FIG. 6

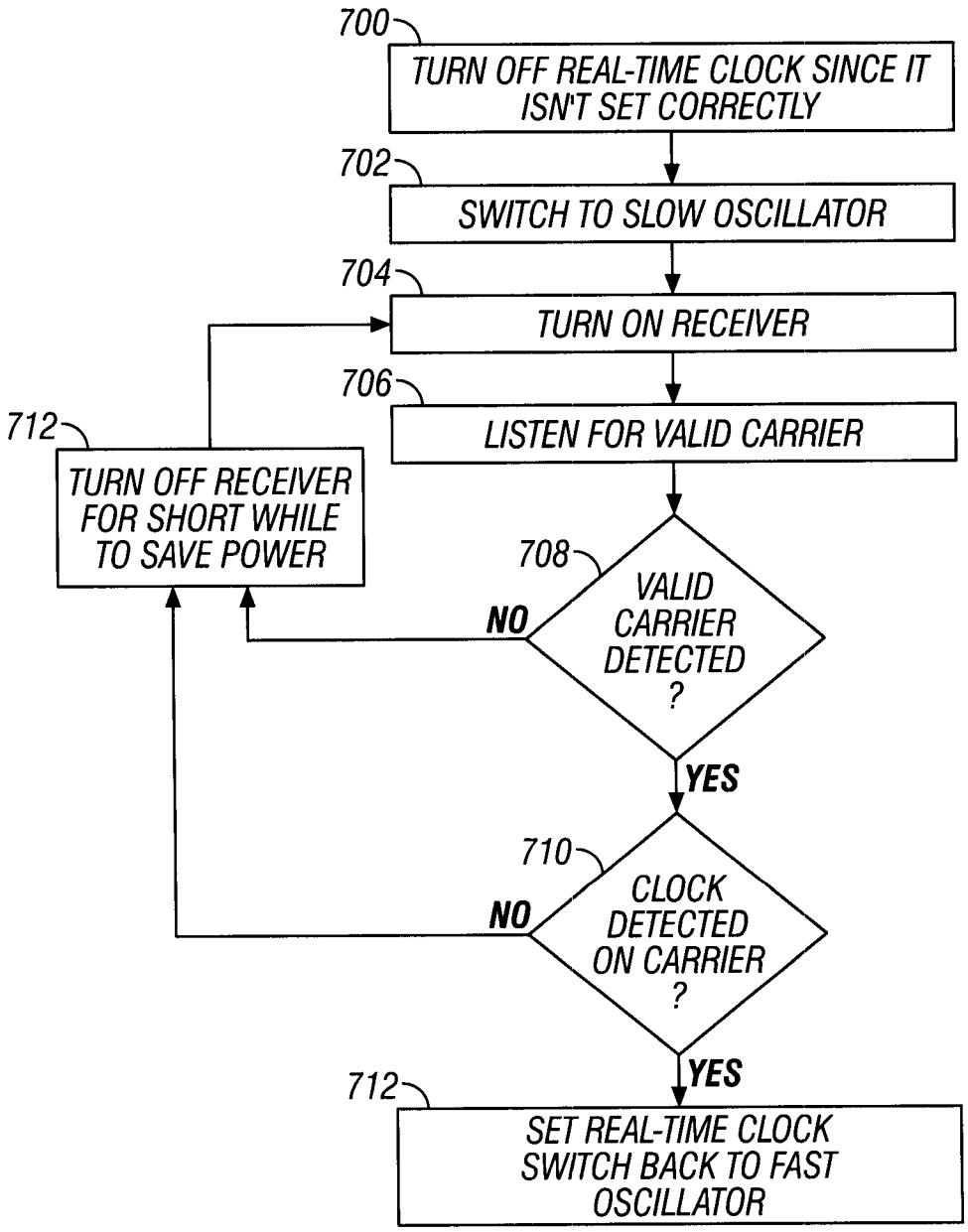
700
TURN OFF REAL-TIME CLOCK SINCE IT ISN'T SET CORRECTLY
702
SWITCH TO SLOW OSCILLATOR
704
TURN ON RECEIVER
706
LISTEN FOR VALID CARRIER
708
VALID CARRIER DETECTED ?
NO
YES
710
CLOCK DETECTED ON CARRIER ?
NO
YES
712
TURN OFF RECEIVER FOR SHORT WHILE TO SAVE POWER
712
SET REAL-TIME CLOCK SWITCH BACK TO FAST OSCILLATOR

FIG. 7

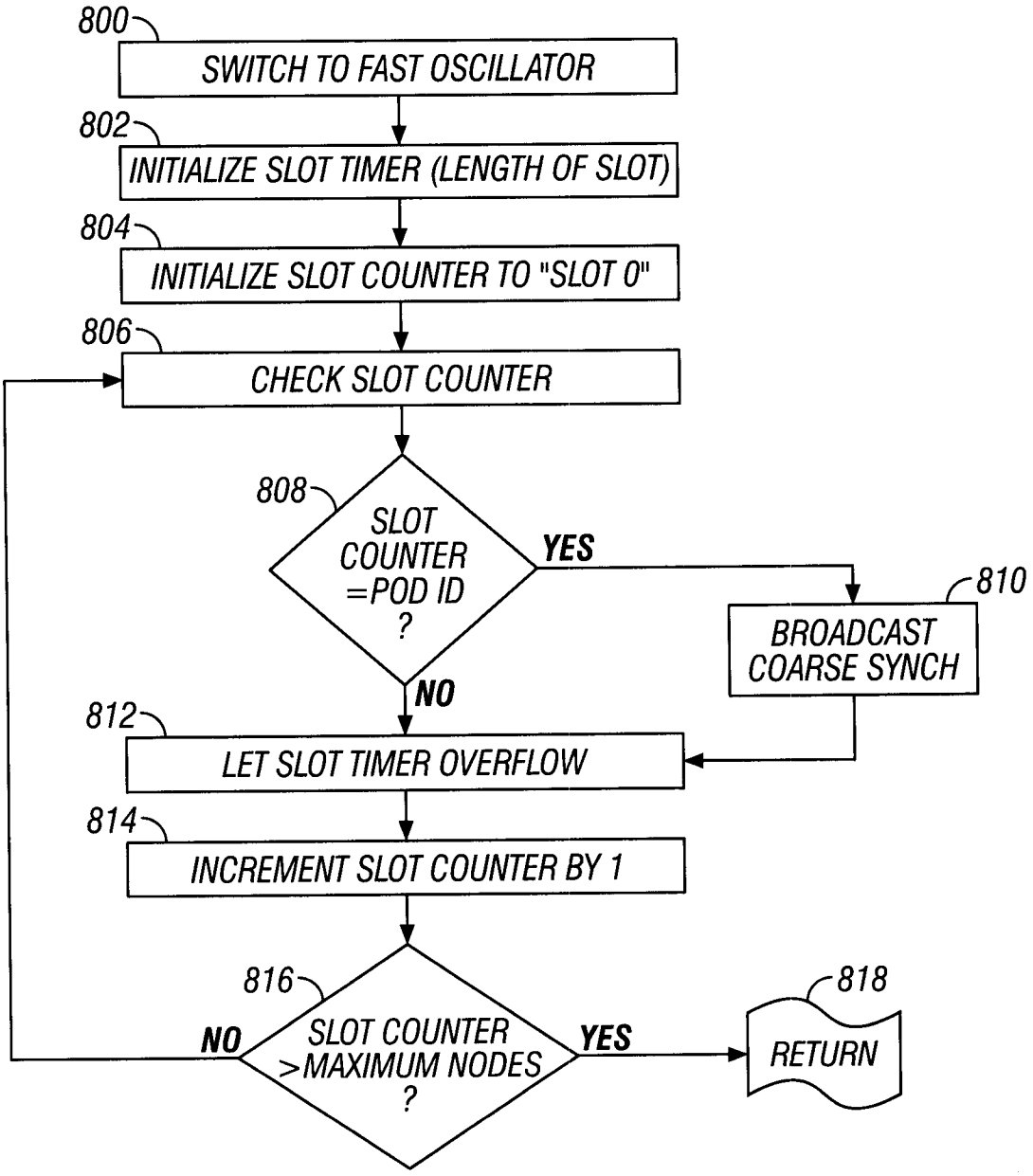
800
SWITCH TO FAST OSCILLATOR
802
INITIALIZE SLOT TIMER (LENGTH OF SLOT)
804
INITIALIZE SLOT COUNTER TO "SLOT 0"
806
CHECK SLOT COUNTER
808
SLOT COUNTER =POD ID ?
YES
NO
810
BROADCAST COARSE SYNCH
812
LET SLOT TIMER OVERFLOW
814
INCREMENT SLOT COUNTER BY 1
816
SLOT COUNTER >MAXIMUM NODES ?
NO
YES
818
RETURN

FIG. 8

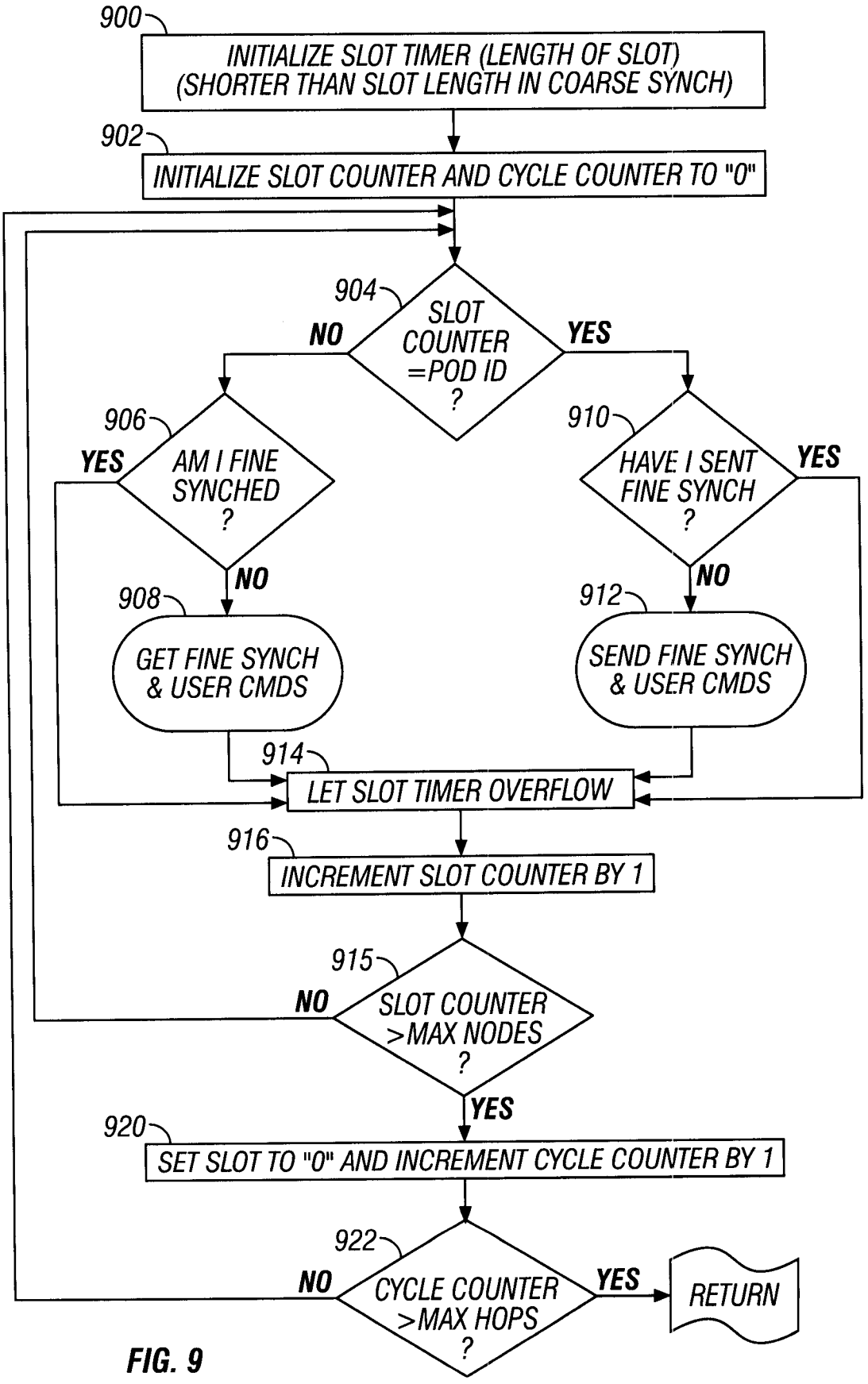
900
INITIALIZE SLOT TIMER (LENGTH OF SLOT)
(SHORTER THAN SLOT LENGTH IN COARSE SYNCH)
902
INITIALIZE SLOT COUNTER AND CYCLE COUNTER TO "0"
904
SLOT COUNTER =POD ID ?
NO
YES
906
AM I FINE SYNCHED ?
YES
NO
908
GET FINE SYNCH & USER CMDS
910
HAVE I SENT FINE SYNCH ?
YES
NO
912
SEND FINE SYNCH & USER CMDS
914
LET SLOT TIMER OVERFLOW
916
INCREMENT SLOT COUNTER BY 1
915
SLOT COUNTER >MAX NODES ?
NO
YES
920
SET SLOT TO "0" AND INCREMENT CYCLE COUNTER BY 1
922
CYCLE COUNTER >MAX HOPS ?
NO
YES
RETURN

FIG. 9

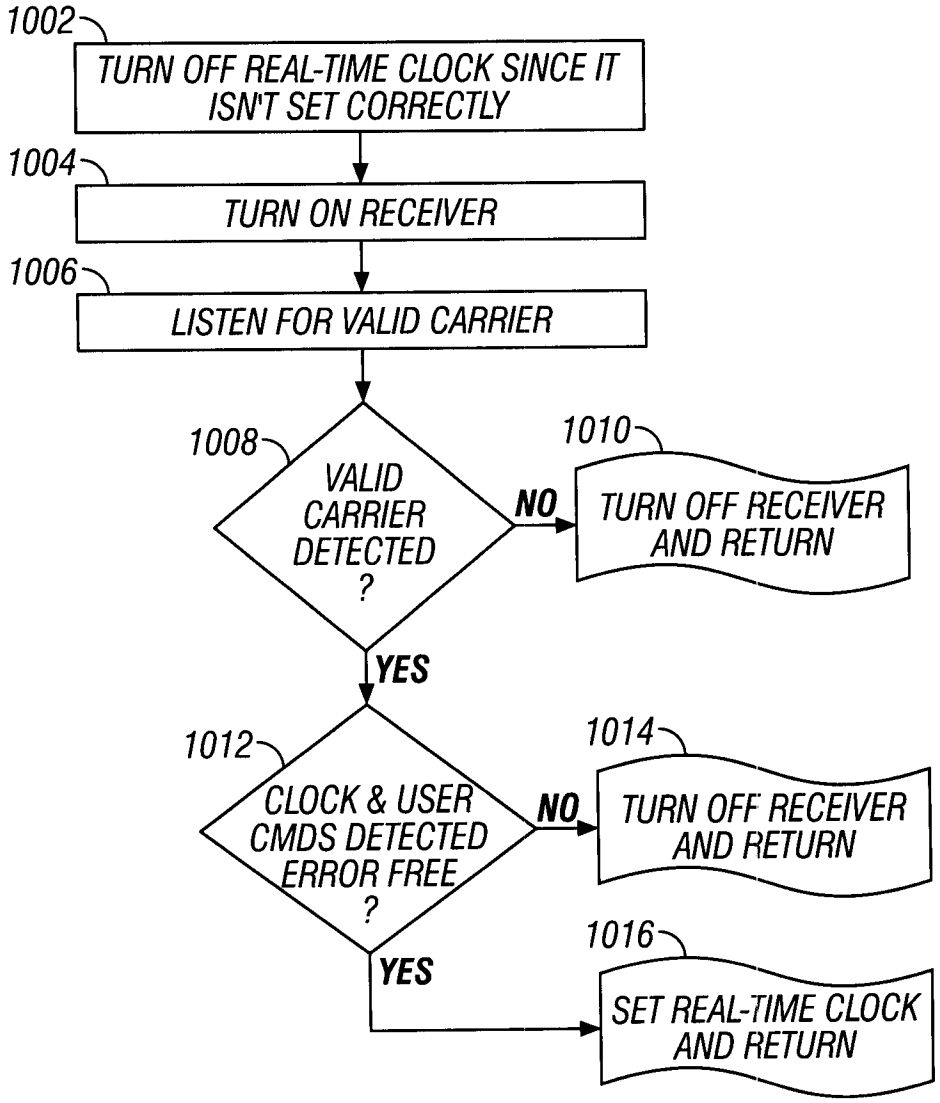
1002
TURN OFF REAL-TIME CLOCK SINCE IT ISN'T SET CORRECTLY
1004
TURN ON RECEIVER
1006
LISTEN FOR VALID CARRIER
1008
VALID CARRIER DETECTED ?
NO
1010
TURN OFF RECEIVER AND RETURN
YES
1012
CLOCK & USER CMDS DETECTED ERROR FREE ?
NO
1014
TURN OFF RECEIVER AND RETURN
YES
1016
SET REAL-TIME CLOCK AND RETURN

FIG. 10

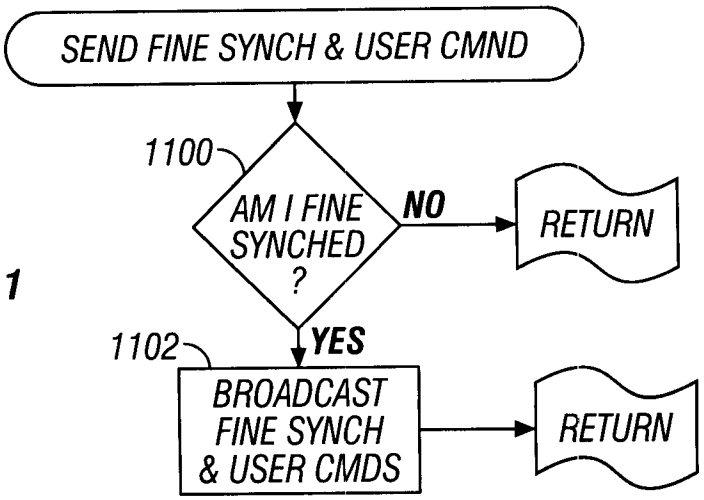
SEND FINE SYNCH & USER CMND
1100
AM I FINE SYNCHED ?
NO
RETURN
YES
1102
BROADCAST FINE SYNCH & USER CMDS
RETURN

FIG. 11

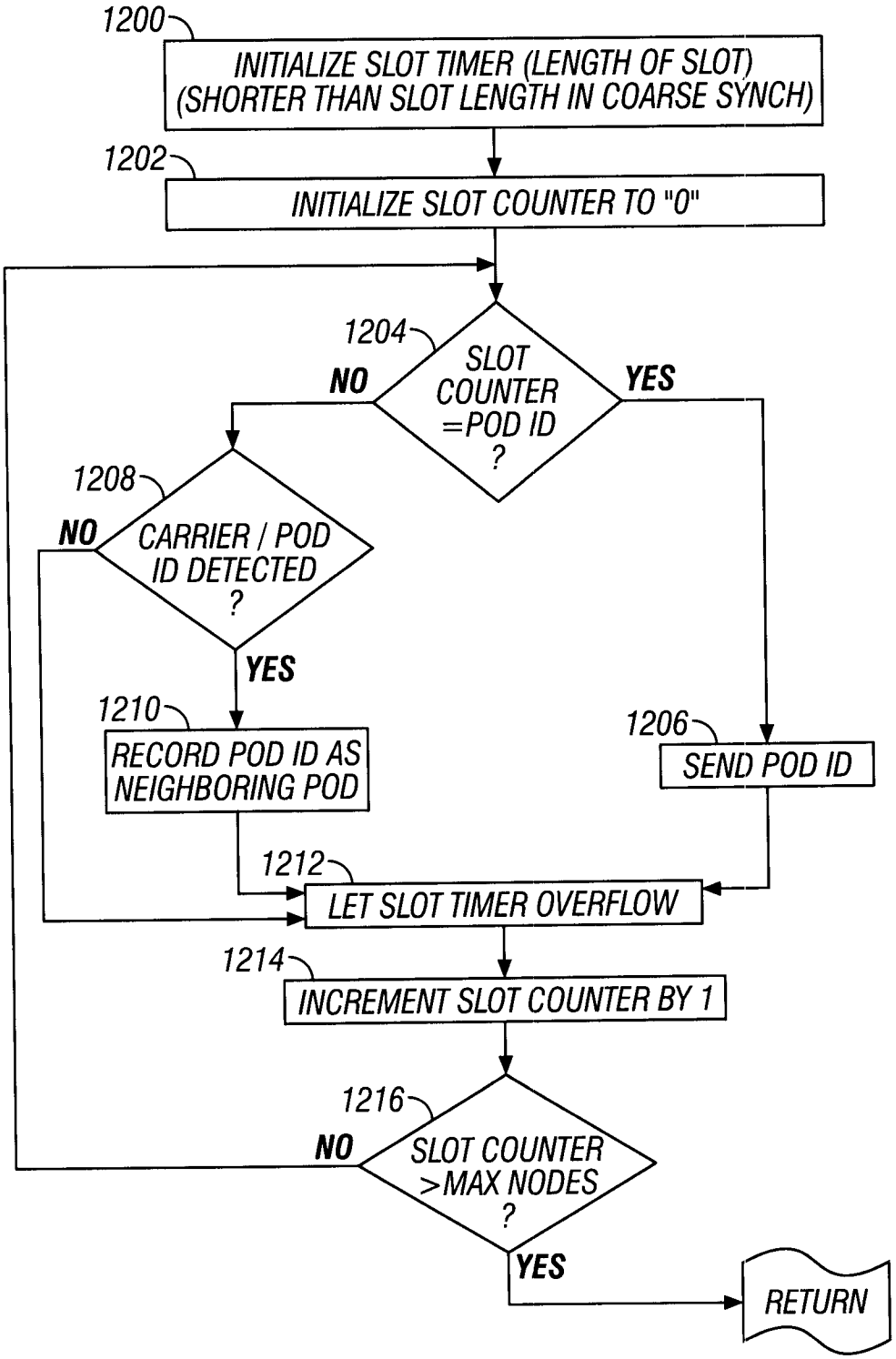
1200
INITIALIZE SLOT TIMER (LENGTH OF SLOT)
(SHORTER THAN SLOT LENGTH IN COARSE SYNCH)
1202
INITIALIZE SLOT COUNTER TO "0"
1204
SLOT COUNTER =POD ID ?
NO
YES
1208
CARRIER / POD ID DETECTED ?
NO
YES
1210
RECORD POD ID AS NEIGHBORING POD
1206
SEND POD ID
1212
LET SLOT TIMER OVERFLOW
1214
INCREMENT SLOT COUNTER BY 1
1216
SLOT COUNTER >MAX NODES ?
NO
YES
RETURN

FIG. 12

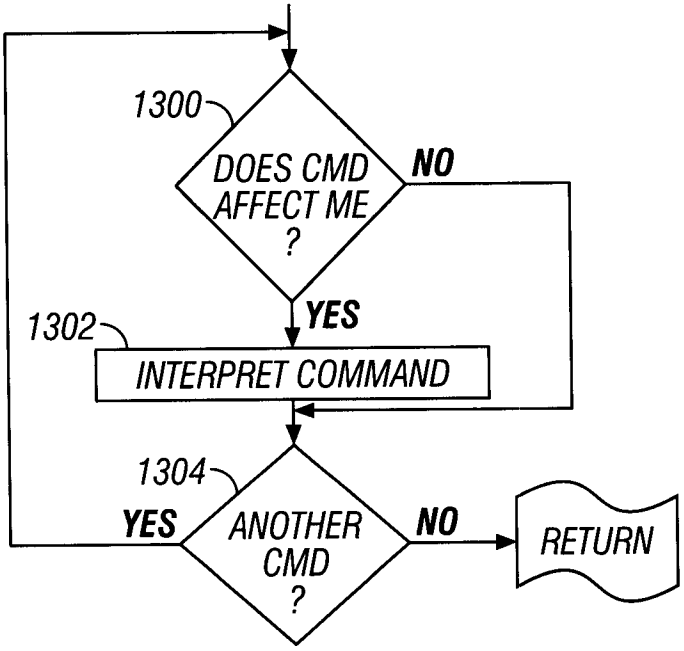
1300
DOES CMD AFFECT ME ?
NO
YES
1302
INTERPRET COMMAND
1304
YES
ANOTHER CMD ?
NO
RETURN

FIG. 13

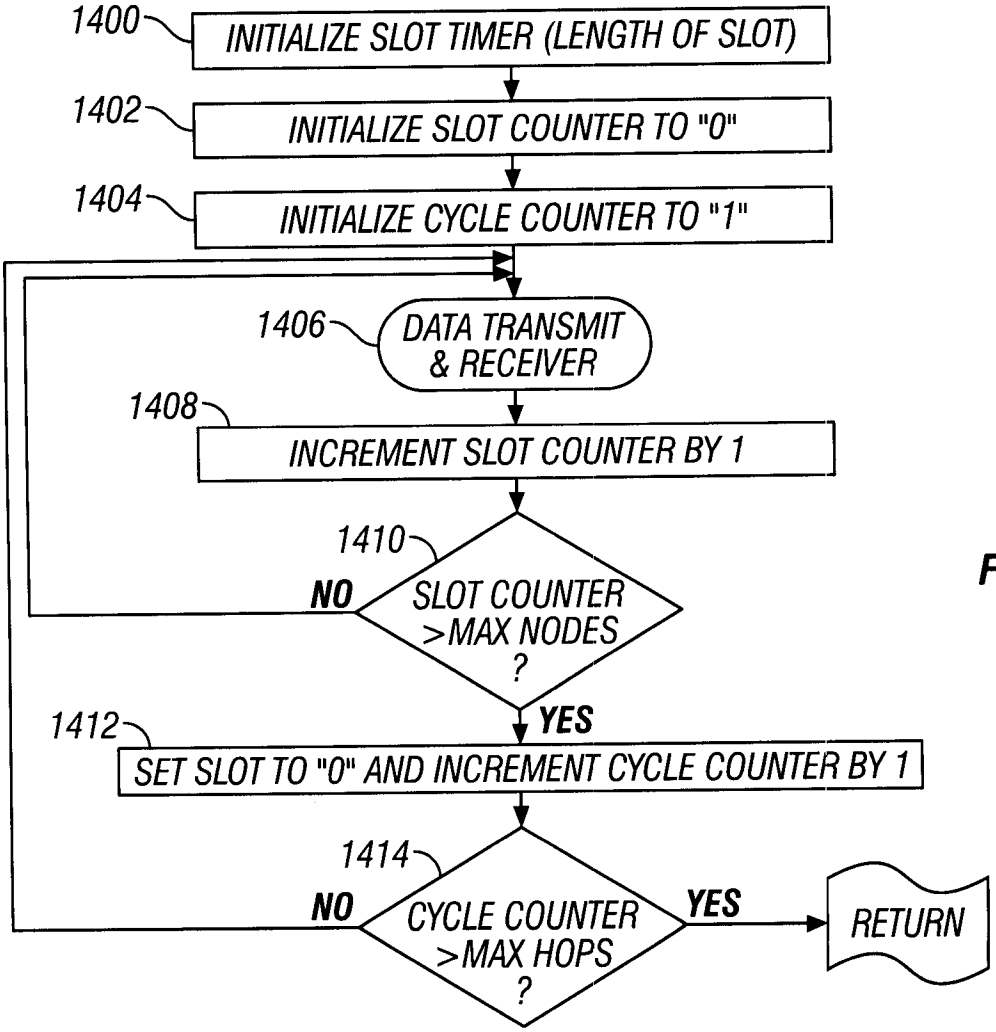
1400
INITIALIZE SLOT TIMER (LENGTH OF SLOT)
1402
INITIALIZE SLOT COUNTER TO "0"
1404
INITIALIZE CYCLE COUNTER TO "1"
1406
DATA TRANSMIT & RECEIVER
1408
INCREMENT SLOT COUNTER BY 1
1410
NO
SLOT COUNTER >MAX NODES ?
YES
1412
SET SLOT TO "0" AND INCREMENT CYCLE COUNTER BY 1
1414
NO
CYCLE COUNTER >MAX HOPS ?
YES
RETURN

FIG. 14

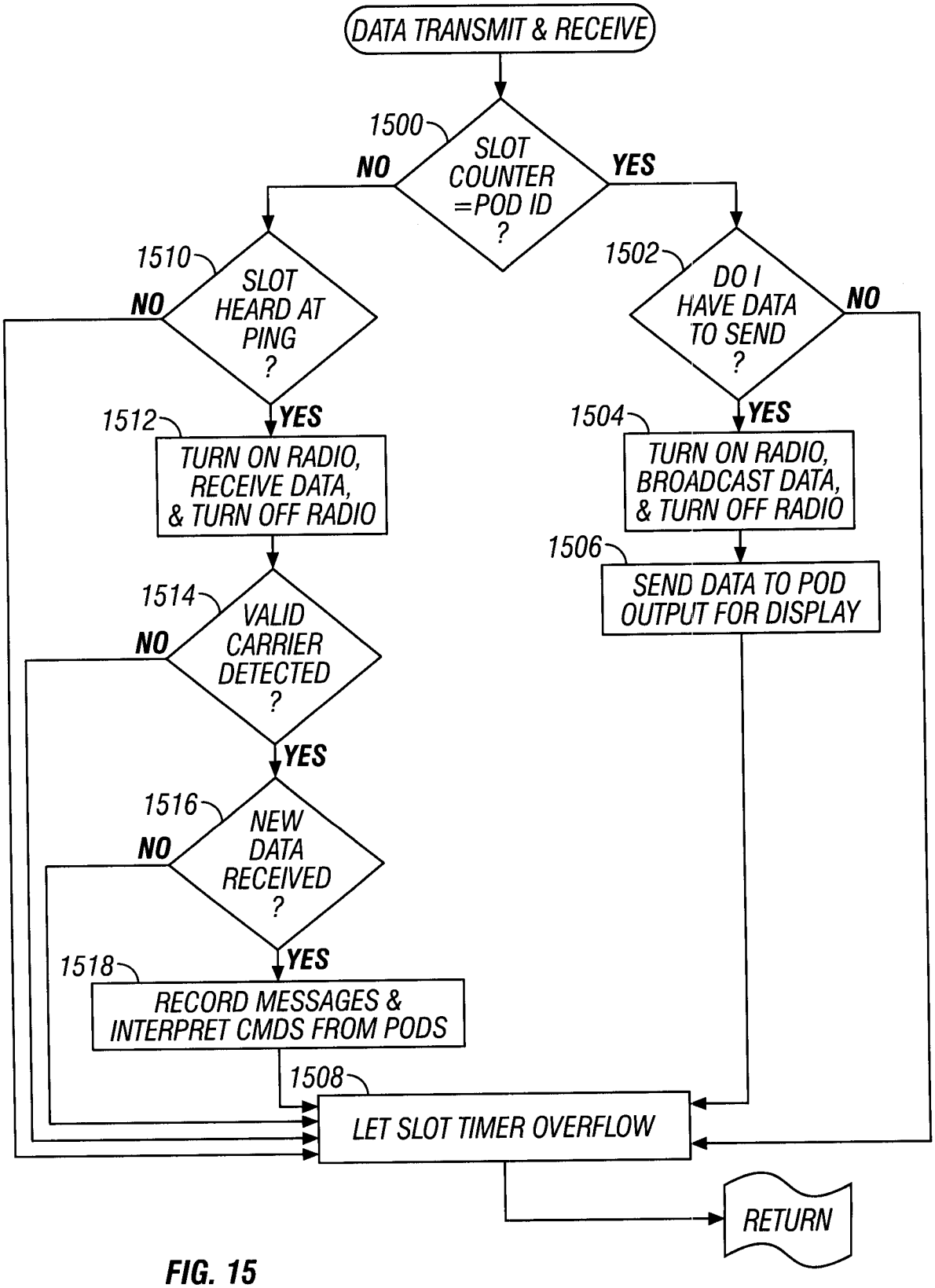
DATA TRANSMIT & RECEIVE
1500
SLOT COUNTER =POD ID ?
NO
YES
1510
SLOT HEARD AT PING ?
NO
YES
1512
TURN ON RADIO, RECEIVE DATA, & TURN OFF RADIO
1514
VALID CARRIER DETECTED ?
NO
YES
1516
NEW DATA RECEIVED ?
NO
YES
1518
RECORD MESSAGES & INTERPRET CMDS FROM PODS
1502
DO I HAVE DATA TO SEND ?
NO
YES
1504
TURN ON RADIO, BROADCAST DATA, & TURN OFF RADIO
1506
SEND DATA TO POD OUTPUT FOR DISPLAY
1508
LET SLOT TIMER OVERFLOW
RETURN

FIG. 15

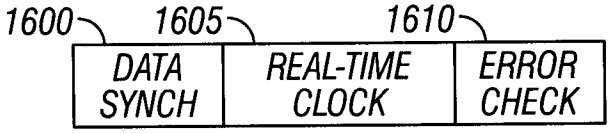

FIG. 16A

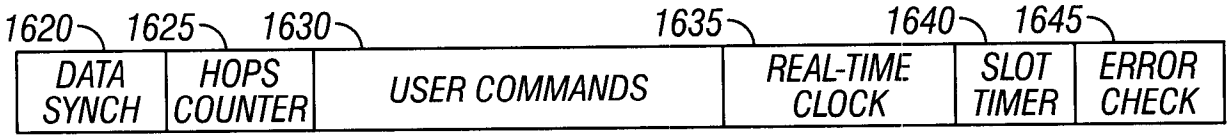

FIG. 16B

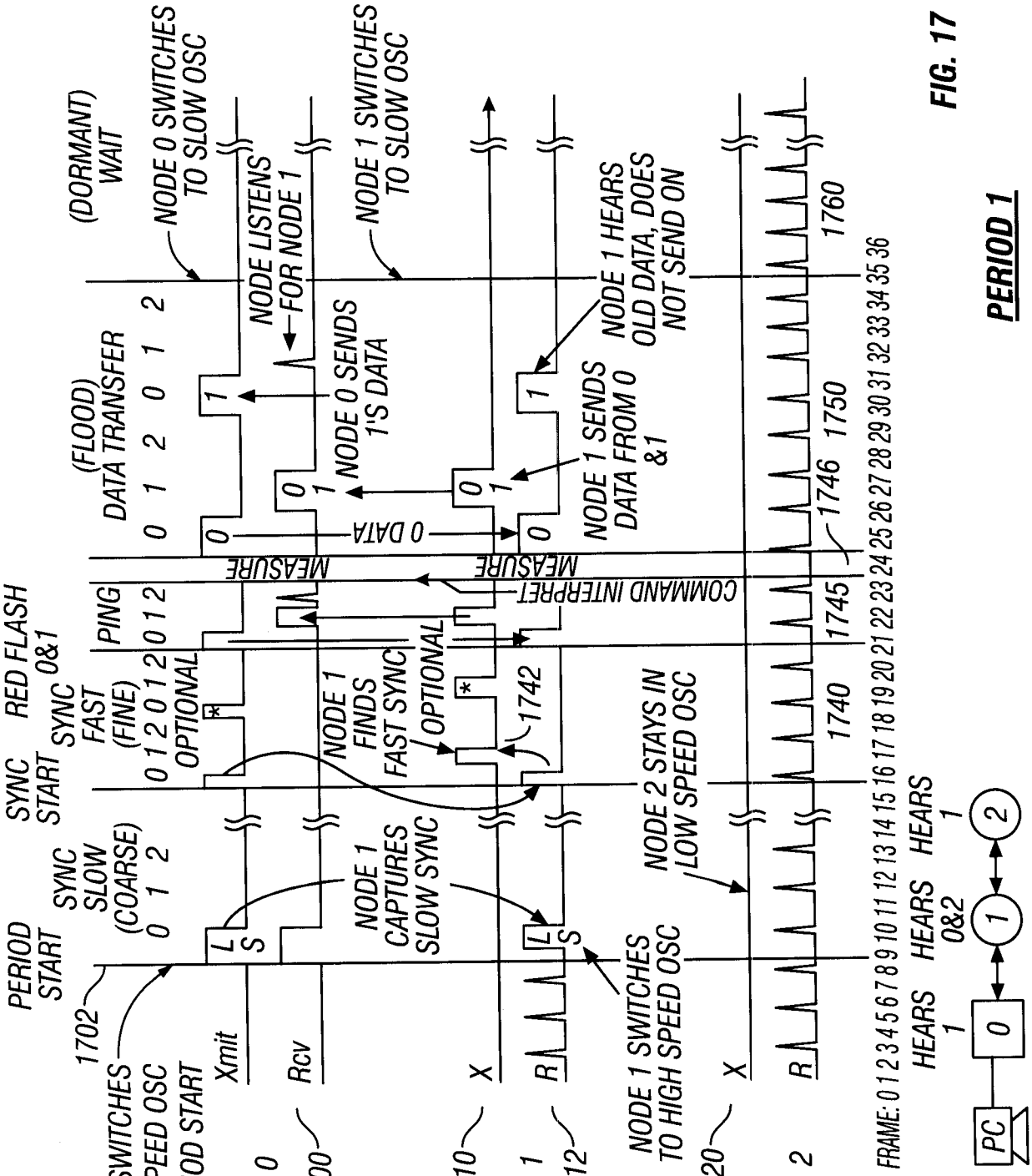

FIG. 17

PERIOD 1

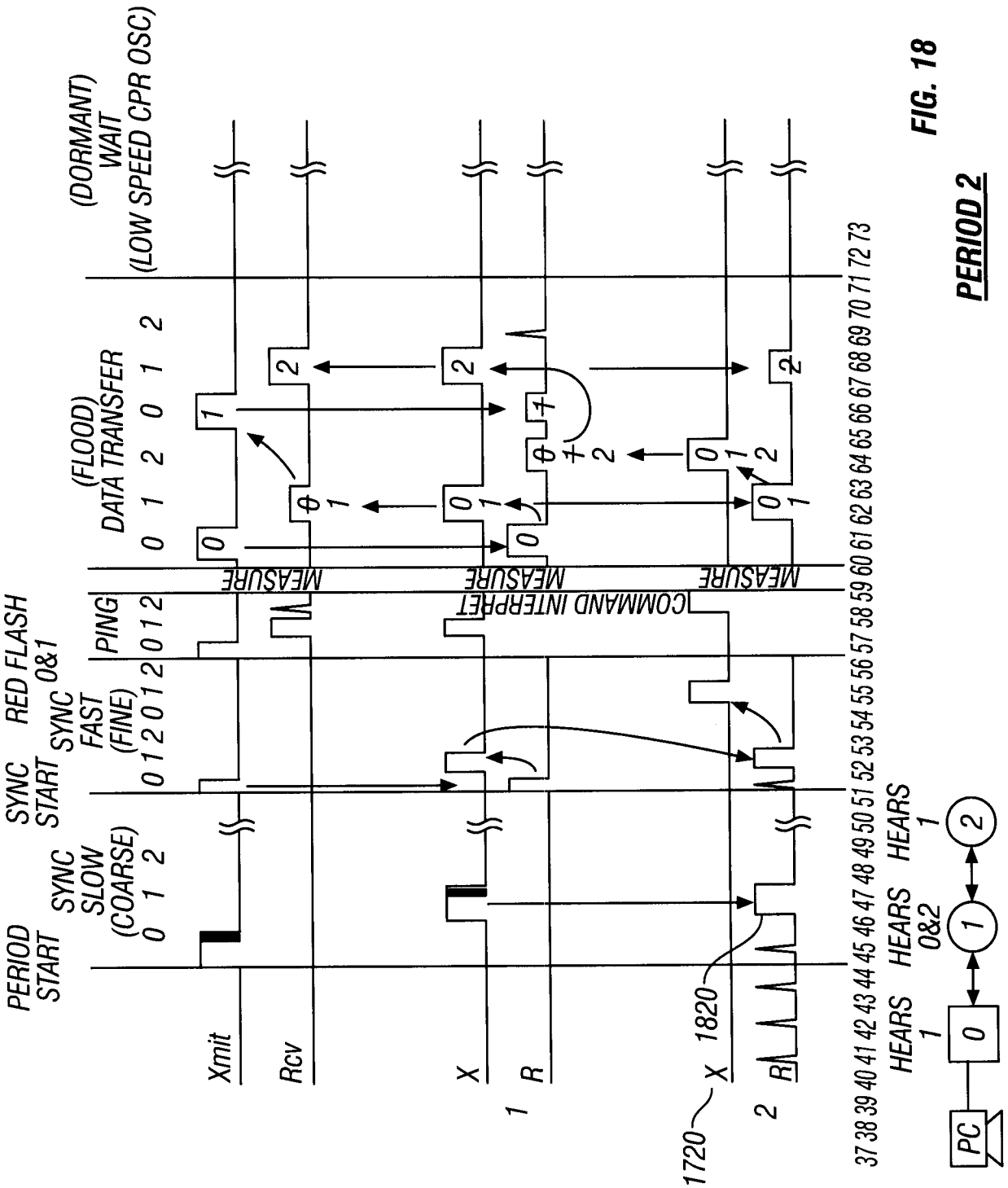

FIG. 18

PERIOD 2